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(54) **RECIRCULATE AND FILTER AIR TO FORM AIR BARRIER IN IMAGE FORMING APPARATUS**

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B41J 29/17 (2006.01)
B41J 29/377 (2006.01)

(52) **U.S. Cl.**
CPC ***B41J 29/17*** (2013.01); ***B41J 2/165*** (2013.01); ***B41J 29/377*** (2013.01)

(58) **Field of Classification Search**
CPC B41J 29/17; B41J 29/377; B41J 2/165
USPC 347/34, 25
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,519,420	A *	5/1996	Zorn et al.	347/25
6,572,294	B2	6/2003	Beehler et al.	
6,890,053	B2	5/2005	Myhill et al.	
7,357,475	B2	4/2008	Silverbrook	
7,571,996	B2	8/2009	Domoto et al.	
7,604,332	B2 *	10/2009	Nagashima	347/84
2003/0016267	A1	1/2003	Green	

FOREIGN PATENT DOCUMENTS

JP	2006282296	A	10/2006
JP	2009-012184	A	1/2009
JP	4551357	B2	7/2010
KR	10-0313866	B1	2/2002
KR	10-2011-0093136	A	8/2011
SG	152033	A1	5/2009

* cited by examiner

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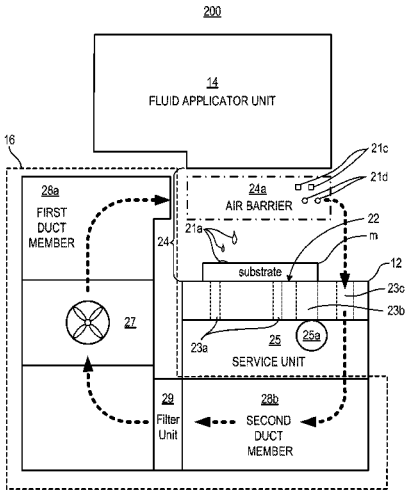
(57) **ABSTRACT**

An image forming apparatus includes a substrate receiving member, a fluid applicator unit, and an air recirculator assembly. The substrate receiving member may selectively receive a substrate. The fluid applicator unit may selectively eject a first set of drops to the substrate received by the substrate receiving member in a print mode and a second set of drops in a maintenance mode. The air recirculater assembly may direct air to form an air barrier across the print zone to redirect at least one of aerosol and particulates from crossing through the air barrier and onto the substrate, to filter the at least one of the aerosol and particulates to form filtered air, and to form the air barrier with the filtered air.

11 Claims, 6 Drawing Sheets



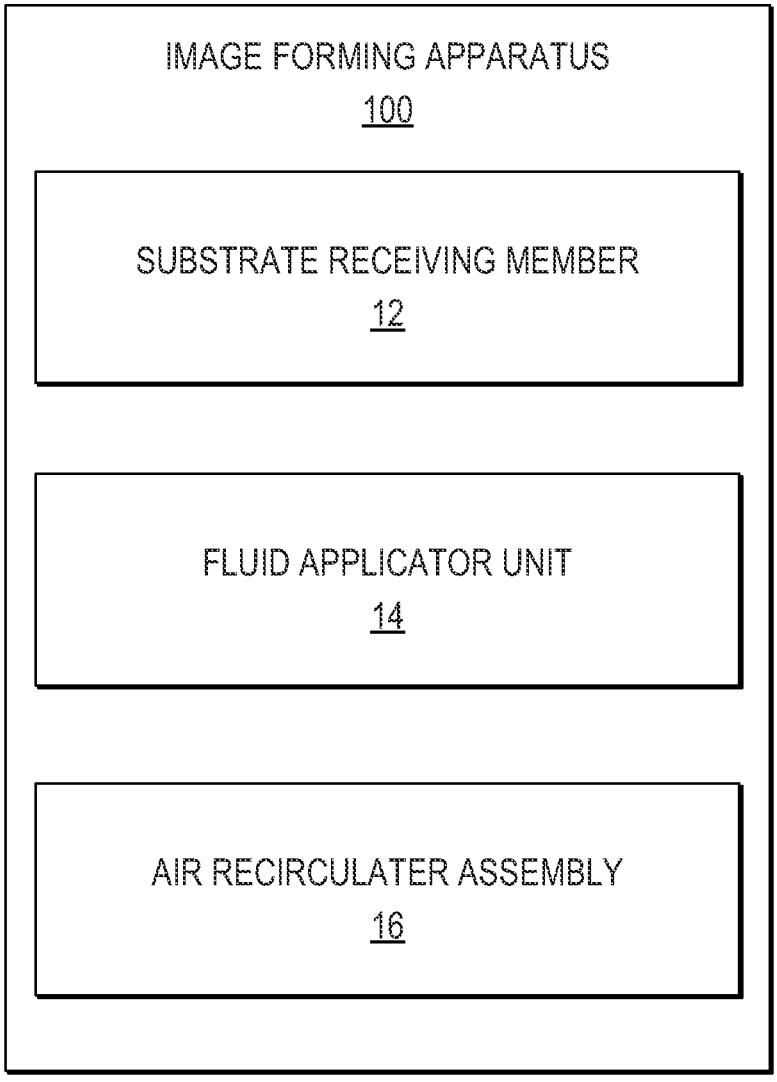


IMAGE FORMING APPARATUS
100
SUBSTRATE RECEIVING MEMBER
12
FLUID APPLICATOR UNIT
14
AIR RECIRCULATER ASSEMBLY
16

Fig. 1

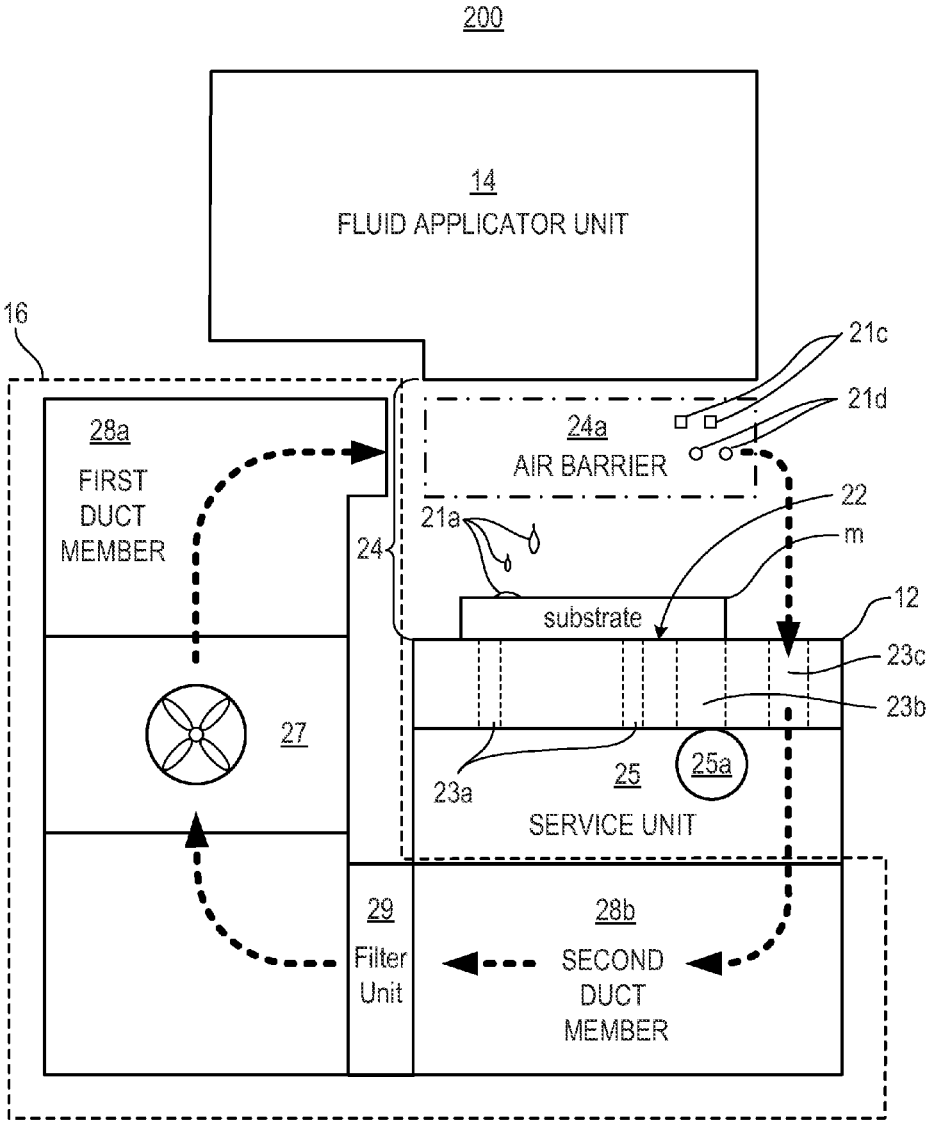

200
14
FLUID APPLICATOR UNIT
16
21c
21d
28a
FIRST
DUCT
MEMBER
24a
AIR BARRIER
22
21a
24
m
substrate
12
23c
23b
27
23a
25
25a
SERVICE UNIT
29
Filter
Unit
28b
SECOND
DUCT
MEMBER

Fig. 2A

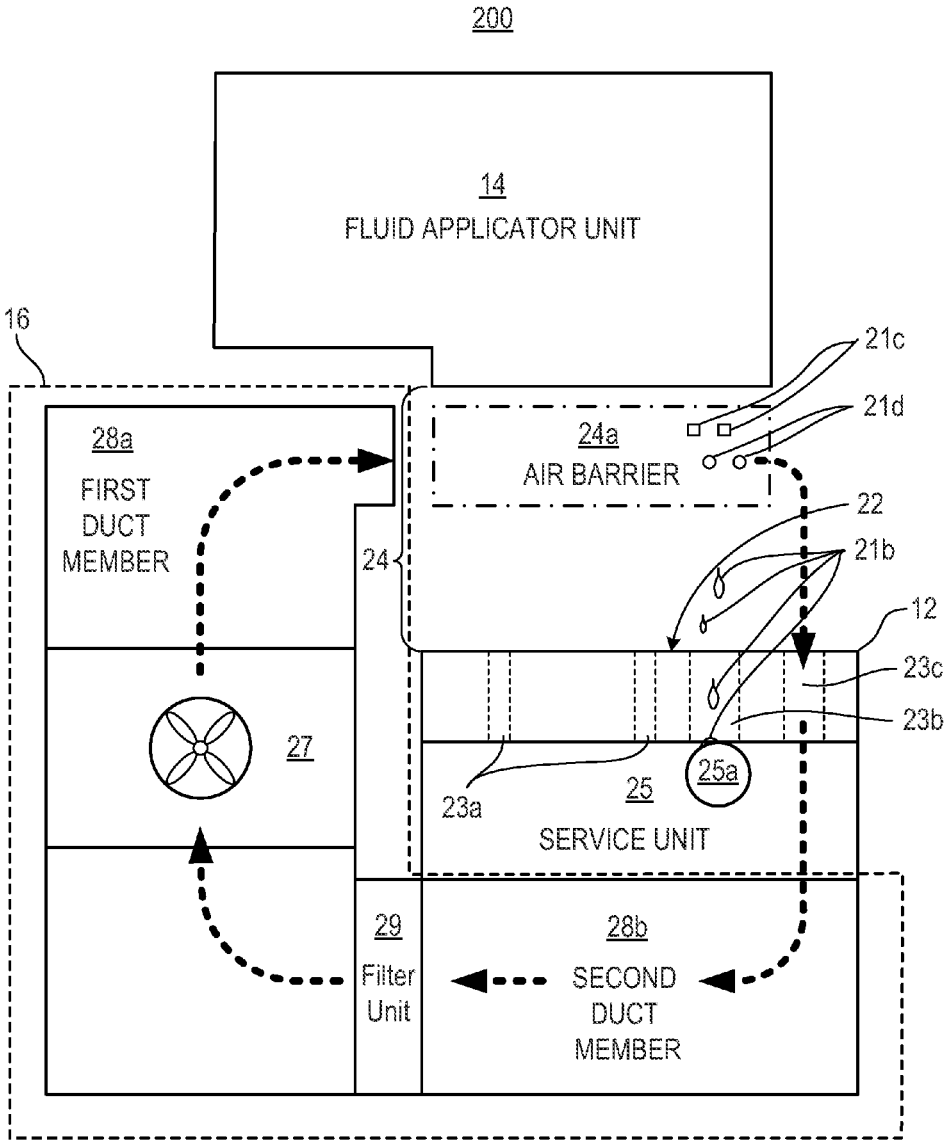

200
14
FLUID APPLICATOR UNIT
16
21c
21d
28a
FIRST
DUCT
MEMBER
24a
AIR BARRIER
22
21b
24
12
23c
23b
27
25a
25
23a
SERVICE UNIT
29
Filter
Unit
28b
SECOND
DUCT
MEMBER

Fig. 2B

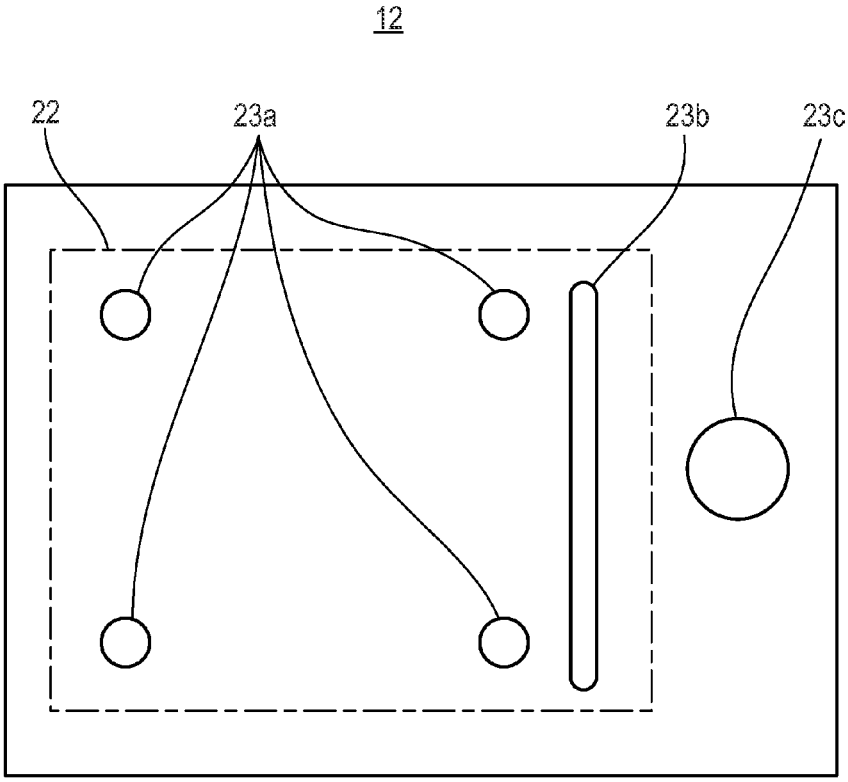


Fig. 3

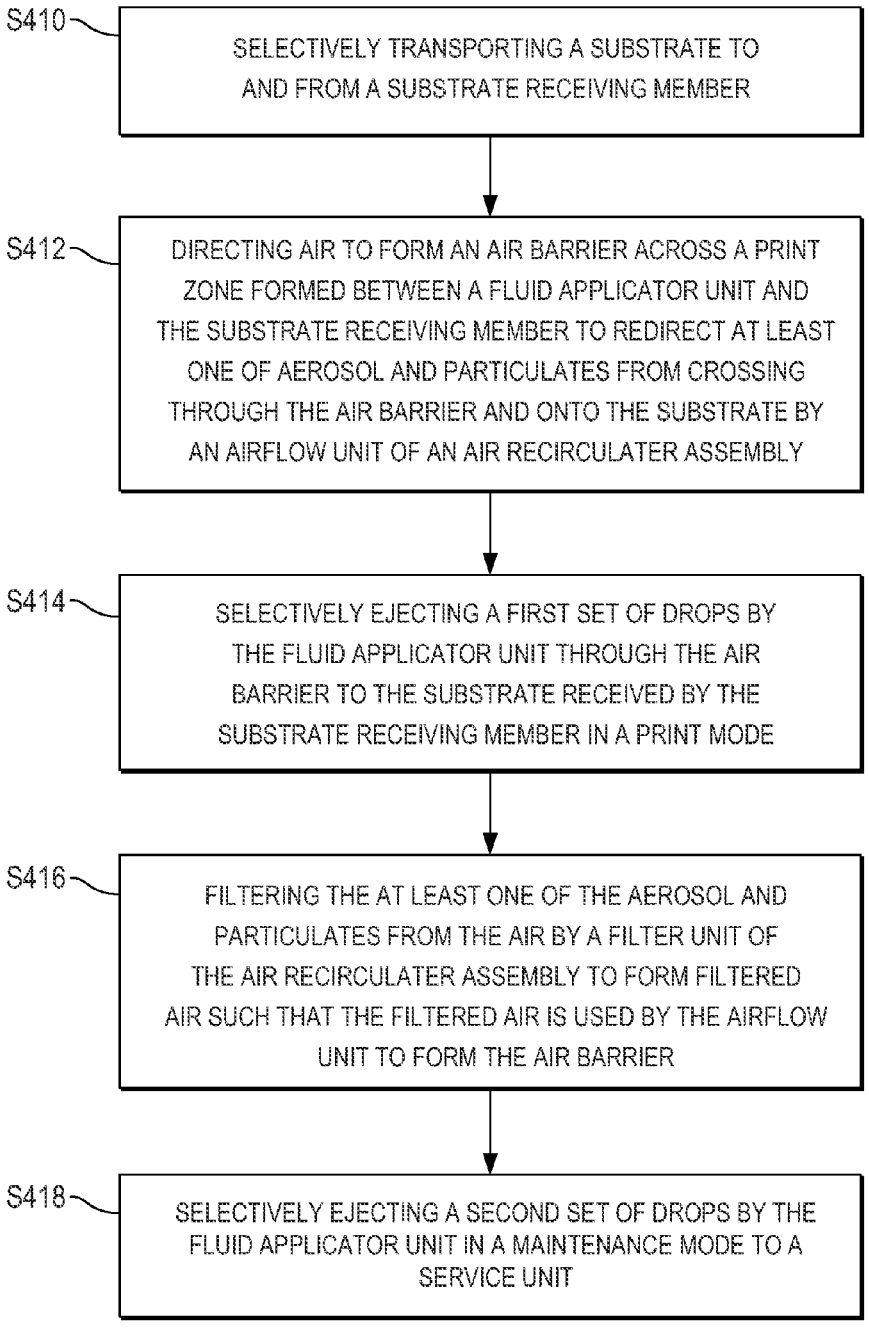

S410
SELECTIVELY TRANSPORTING A SUBSTRATE TO AND FROM A SUBSTRATE RECEIVING MEMBER
S412
DIRECTING AIR TO FORM AN AIR BARRIER ACROSS A PRINT ZONE FORMED BETWEEN A FLUID APPLICATOR UNIT AND THE SUBSTRATE RECEIVING MEMBER TO REDIRECT AT LEAST ONE OF AEROSOL AND PARTICULATES FROM CROSSING THROUGH THE AIR BARRIER AND ONTO THE SUBSTRATE BY AN AIRFLOW UNIT OF AN AIR RECIRCULATER ASSEMBLY
S414
SELECTIVELY EJECTING A FIRST SET OF DROPS BY THE FLUID APPLICATOR UNIT THROUGH THE AIR BARRIER TO THE SUBSTRATE RECEIVED BY THE SUBSTRATE RECEIVING MEMBER IN A PRINT MODE
S416
FILTERING THE AT LEAST ONE OF THE AEROSOL AND PARTICULATES FROM THE AIR BY A FILTER UNIT OF THE AIR RECIRCULATER ASSEMBLY TO FORM FILTERED AIR SUCH THAT THE FILTERED AIR IS USED BY THE AIRFLOW UNIT TO FORM THE AIR BARRIER
S418
SELECTIVELY EJECTING A SECOND SET OF DROPS BY THE FLUID APPLICATOR UNIT IN A MAINTENANCE MODE TO A SERVICE UNIT

Fig. 4

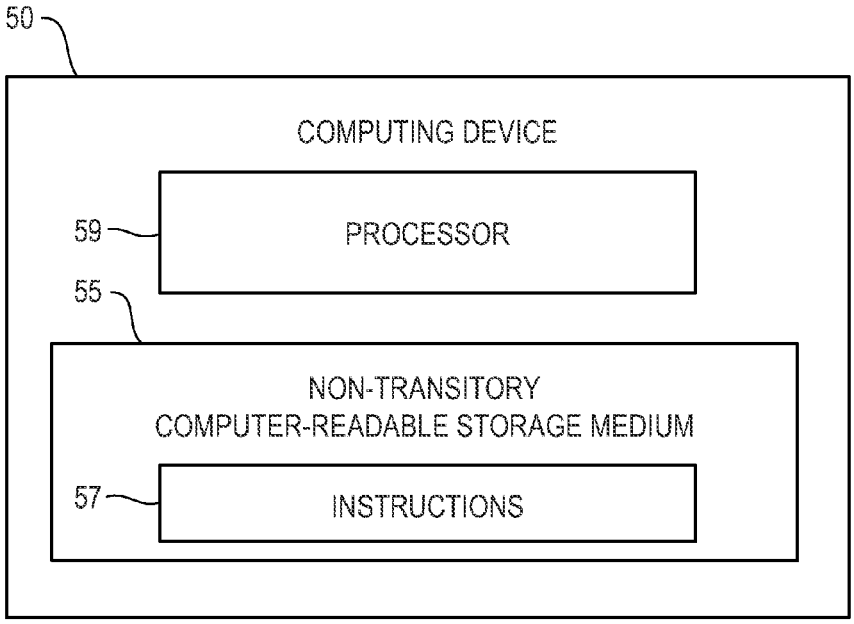

50
COMPUTING DEVICE
59
PROCESSOR
55
NON-TRANSITORY
COMPUTER-READABLE STORAGE MEDIUM
57
INSTRUCTIONS

Fig. 5

RECIRCULATE AND FILTER AIR TO FORM AIR BARRIER IN IMAGE FORMING APPARATUS

BACKGROUND

Image forming apparatuses may include fluid applicator units to eject fluid such as ink in the form of drops on substrates. The image forming apparatuses may form an air barrier to reduce an amount of aerosol, particulates, and the like, from being deposited on the substrate, fluid applicator unit, and/or other components of the image forming apparatuses.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting examples are described in the following description, read with reference to the figures attached hereto and do not limit the scope of the claims. Dimensions of components and features illustrated in the figures are chosen primarily for convenience and clarity of presentation and are not necessarily to scale. Referring to the attached figures:

FIG. **1** is a block diagram of an image forming apparatus according to an example.

FIG. **2**A is schematic side view of a image forming apparatus in a print mode according to an example.

FIG. **2**B is a schematic side view of an image forming apparatus in a maintenance mode according to an example.

FIG. **3** is a top view of a substrate receiving member of the image forming apparatus of FIG. **2**B according to an example.

FIG. **4** is a flowchart illustrating a method of recirculating air in an image forming apparatus according to an example.

FIG. **5** is a block diagram illustrating a computing device such as an image forming apparatus including a processor and a non-transitory, computer-readable storage medium to store instructions to operate the computing device to recirculate air according to an example.

DETAILED DESCRIPTION

Image forming apparatuses may include fluid applicator units to eject fluid such as ink in the form of drops on substrates. The image forming apparatuses may form an air barrier to reduce an amount of aerosols, particulates, and the like, from being deposited on the substrate, fluid applicator unit, and/or other components of the image forming apparatuses. The image forming apparatuses may also periodically perform maintenance procedures to maintain flow paths within the fluid applicator units in order to properly eject drops there from. That is, in a maintenance mode, the fluid applicator unit may periodically perform spitting procedures in which fluid is ejected from the fluid applicator unit in the form of drops there from. The drops ejected from the fluid application units, however, may form aerosol which, if not properly removed, may contaminate the substrate and/or components of the image forming apparatuses. Further, aerosol can cloud optical sensors causing premature failure, increase friction in rotating members, deposit on media path surfaces increasing friction and potentially causing a leak out of the image forming apparatus dirtying both the interior and surroundings. In addition, the combination of aerosol with other particulates can interact to increase these issues by forming sticky, globular masses. Further, particulates such as dust, paper debris, and the like, may also contaminate the substrate. Thus, the aerosol and/or particulates may cause image defects, component malfunctions, and/or reduce the lifespan of the image forming apparatuses.

In examples, an image forming apparatus includes, amongst other things, a substrate receiving member, a fluid applicator unit, and an air recirculator assembly. The fluid applicator unit it may selectively eject a first set of drops to the substrate received by the substrate receiving member in a print mode and a second set of drops in a maintenance mode. The air recirculater assembly may direct air to form an air barrier across the print zone to redirect at least one of aerosol and particulates from crossing through the air barrier and onto the substrate, to filter the at least one of the aerosol and particulates to form filtered air, and to form the air barrier with the filtered air. Accordingly, adequate redirection and extraction of aerosol and/or particulates may be effectively performed. Additionally, the substrate may be prevented from contacting a surface of the fluid applicator unit. Thus, image forming defects, component malfunctions, and the reduction in the lifespan of the image forming apparatus may be reduced.

FIG. **1** is block diagram of an image forming apparatus according to an example. Referring to FIG. **1**, in some examples, an image forming apparatus **100** includes a substrate receiving member **12**, a fluid applicator unit **14**, and an air recirculater assembly **16**. The substrate receiving member **12** may selectively receive a substrate. That is, the substrate may be transported along a substrate transport path to be placed on the substrate receiving member **12**. The substrate may include media such as paper, vinyl, plastic, cloth, and the like. In some examples, different sized substrate may be received by the substrate receiving member **12**. The substrate receiving member **12** may be a platen, and the like.

Referring to FIG. **1**, in some examples, the fluid applicator unit **14** may selectively eject a first set of drops to the substrate disposed on the substrate receiving member **12** in a print mode. The fluid applicator unit **14** may also selectively eject a second set of drops in a maintenance mode. That is, the print mode is a mode in which a first set of drops of fluid are ejected by the fluid applicator unit **14** onto the substrate. For example, the first set of drops may form images on the substrate. Alternatively, the maintenance mode is a mode in which a second set of drops of fluid are ejected by the fluid applicator unit **14** to maintain flow paths in the fluid applicator unit **12** for proper ejection of subsequent first set of drops there from.

In some examples, the fluid applicator unit **14** may include at least one inkjet print head to eject ink in the form of drops. For example, the fluid applicator unit **14** may be a page wide inkjet print head array that includes a plurality of inkjet print heads that extend across a width of a substrate transport path. That is, the plurality of inkjet print heads may extend across a width of a substrate passing into a print zone and disposed on the substrate receiving member **12**. The fluid applicator unit **14** and the substrate receiving member **12** may form a print zone there between. The air recirculater assembly **16** may direct air to form an air barrier across the print zone to redirect at least one of aerosol and particulates from crossing through the air barrier and onto the substrate. The air recirculater assembly **16** may also filter the at least one of the aerosol and particulates to form filtered air. The air recirculater assembly **16** may also form the air barrier with the filtered air. Additionally, the substrate may be prevented from contacting a surface of the fluid applicator unit **14**.

FIG. **2**A is a schematic side view of an image forming apparatus in a print mode according to an example. FIG. **2**B is a schematic side view of an image forming apparatus in a maintenance mode according to an example. Referring to FIGS. **2**A and **2**B, in some examples, an image forming apparatus **200** may include a substrate receiving member **12**, a fluid applicator unit **14**, and an air recirculater assembly **16**

as previously disclosed with respect to the image forming apparatus **100** of FIG. **1**. In some examples, the image forming apparatus **200** may also include a service unit **25**. The service unit **25** may receive at least one of the second set of drops **21***b* and the at least one of the aerosol **21***c* and particulates **21***d*. In some examples, the service unit **25** may include a maintenance member **25***a* to collect at least one of the second set of drops **21***b* and the at least one of the aerosol **21***c* and particulates **21***d*. For example, the maintenance member **25***a* may be in a form of a spit roller, and the like.

Referring to FIGS. **2**A and **2**B, in some examples, in the maintenance made, the substrate m does not cover the at least one maintenance opening **23***b* (e.g., the substrate m moved from or not yet received on the substrate receiving area **22**) and the second set of drops **21***b* ejected from the fluid applicator unit **14** pass through the maintenance opening **23***b* and onto the maintenance member **25***a* as illustrated in FIG. **2**B. In some examples, the air recirculater assembly **16** may include a filter unit **29** and an airflow unit **27**, **28***a* and **28***b*. The filter unit **28** may filter the at least one of the aerosol **21***c* and particulates **21***d* from the air. That is, the filter unit **29** is able to remove a large percentage of aerosol and particulates before the air flow moves to the first duct member **28***a*. In some examples, the filter unit **29** may include an aerosol filter, and the like. For example, the filter unit **29** may include at least one of needlefelt, polyester, open cell, closed cell, pleated, charged, and the like.

Referring to FIGS. **2**A and **2**B, in some examples, the airflow unit **27**, **28***a* and **28***b* may direct the air to pass through the filter unit **29** to form the filtered air and direct the filtered air to form the air barrier **24***a*. In some examples, the air may be directed by the fan **27** in multiple paths to subsequently meet to form the air barrier **24***a*. The airflow unit **27**, **28***a* and **28***b* may include a fan **27**, a first duct member **28***a* and a second duct member **28***b*. The fan **27** may suck the air forming the air barrier **24***a* including the at least one of the aerosol **21***c* and particulates **21***d* through the filter unit **29** to form the filtered air. The fan **27** may also push the filtered air across the print zone **24** to form the air barrier **24***a*. The first duct member **28***a* may be disposed between the fan **27** and the print zone **24**. The first duct member **28***a* may form a first channel to guide the filtered air from the fan **27** to the print zone **24**. The second duct member **28***b* may be disposed between the fan **27** and the substrate receiving member **12** to form a second channel to guide the air to the fan **27**. In some examples, the filter unit **29** may be disposed in the second duct member **28***b*.

FIG. **3** is a top view of a substrate receiving member of the image forming apparatus of FIG. **2**B according to an example. Referring to FIGS. **2**B and **3**, in some examples, a substrate receiving member **12** may also include a substrate receiving area **22** to receive the substrate m and at least one recirculation opening **23***c* for the air to pass through the substrate receiving member **12** to the second duct member **28***b*. For example, the recirculation opening **23***c* may allow a continuous path of air to and from the fan **27** to the air to remove the aerosol and/or particulates there from and for the filtered air to form the air barrier **24***a*. Recirculation of the air flow provides additional filtering of the air as it makes air flow in the system closed-loop to a large extent. Even if the aerosol makes it through the filter unit **29** during an initial pass, it is likely that it will be impacted onto maintenance member **25**A. In some examples, this process will repeat continuously as long as the fan **27** is running. In some examples, the substrate receiving area **22** may also include a plurality of positioning holes **23***a* and at least one maintenance hole **23***b*. The plurality of positioning holes **23***a* may enable the fan **27** to suck the air to selectively hold the substrate m against the substrate receiving area **22** in the print mode.

Referring to FIGS. **2**A, **2**B and **3**, in some examples, the at least one maintenance hole **23***b* may allow the second set of drops **21***b* electively ejected from the fluid applicator unit **14** to pass through the substrate calving member **12** to the maintenance member **25***a* of the service unit **25**. In some examples, the substrate m may uncover the at least one maintenance hole **23***b* to enable the second set of drops **21***b* to be received by the service unit **25** and/or contact the maintenance member **25***a*. That is, the second set of drops **21***b* may be selectively ejected in the maintenance mode before the substrate m is received by or after the substrate m is moved from the substrate receiving area **22** of the substrate receiving member **12**.

FIG. **4** is a flowchart illustrating a method of recirculating air in an image forming apparatus according to an example. Referring to FIG. **4**, in block S**410**, a substrate is selectively transported to and from a substrate receiving member. In block S**412**, air is directed by an airflow unit of an air recirculater assembly to form an air barrier across a print zone formed between a fluid applicator unit and the substrate receiving member to redirect at least one of aerosol and particulates from crossing through the air barrier and onto the substrate. For example, filtered air may be pushed across the print zone by a fan to form the air barrier. In block S**414**, a first set of drops is selectively ejected by the fluid applicator unit through the it barrier to the substrate received by the substrate receiving member in a print mode.

Referring to FIG. **4**, in block S**416** the at least one of the aerosol and particulates is filtered from the air by a filter of the air recirculater assembly to form filtered air. For example, the air forming the air barrier including the at least one of the aerosol and particulates may be sucked through the filter unit by a fan to form the filtered air. That is, the air forming the air barrier may be passed through at least one recirculation opening disposed through the substrate receiving member and through the filter unit. In some examples, the filtered air may be used by the airflow unit to form the air barrier. In block S**418**, a second set of drops is selectively ejected by the fluid applicator unit in a maintenance mode to a service unit. For example, the second set of drops ejected from the fluid applicator unit may be ejected through at least one maintenance hole disposed through the substrate receiving member to a maintenance member of the service unit. In some examples, operations S**410** to S**418** may be continuously repeated, for example, while the image forming apparatus is turned on, in a printing mode, and/or in a maintenance mode.

FIG. **5** is a block diagram illustrating a computing device such as an image forming apparatus including a processor and a non-transitory, computer-readable storage medium to store instructions to operate the computing device to recirculate air according to an example. Referring to FIG. **5**, in some examples, the non-transitory, computer-readable storage medium may be included in a computing device **50** such as an image forming apparatus **100** and **200**. In some examples, the non-transitory, computer-readable storage medium **55** may be implemented in whole or in part as computer-implemented instructions stored in the image forming apparatus **100** and **200** locally or remotely, for example, in a server or a host computing device considered herein to be part of the image forming apparatus **100** and **200**.

Referring to FIG. **5**, in some examples, the non-transitory, computer-readable storage medium **55** may correspond to a storage device that stores computer-implemented instructions, such as programming code, and the like. For example, the non-transitory, computer-readable storage medium **55**

may include a non-volatile memory, a volatile memory, and/or a storage device. Examples of non-volatile memory include, but are not limited to, electrically erasable programmable read only memory (EEPROM) and read only memory (ROM). Examples of volatile memory include, but are not limited to, stat random access memory (SRAM), and dynamic random access memory (DRAM).

Referring to FIG. **5**, examples of storage devices include, but are not limited to, hard disk drives, compact disc drives, digital versatile disc drives, optical drives, and flash memory devices. In some examples, the non-transitory, computer-readable storage medium **55** may even be paper or another suitable medium upon which the instructions **57** are printed, as the instructions **57** can be electronically captured, via, for instance, optical scan in of the paper or other medium, then compiled, interpreted or otherwise processed in a single manner, if necessary, and then stored therein. A processor **69** generally retrieves and executes the instructions **57** stored in the non-transitory, computer-readable storage medium **55**, for example, to operate a computing device **50** such as an image forming apparatus **100** and **200** to recirculate air in accordance with an example. In an example, the non-transitory, computer-readable storage medium **55** can be accessed by the processor **59**.

It is to be understood that the flowchart oaf FIG. **4** illustrates architecture, functionality, and/or operation of examples of the present disclosure. If embodied in software, each block may represent a module, segment, or portion of code that includes one or more executable instructions to implement the specified logical function(s). If embodied in hardware, each block may represent a circuit or a number of interconnected circuits to implement the specified logical function(s). Although the flowchart of FIG. **4** illustrates a specific order of execution, the order of execution may differ from that which is depicted. For example, the order of execution of two or more blocks may be scrambled relative to the order illustrated. Also, two or more blocks illustrated in succession in FIG. **4** may be executed concurrently or with partial concurrence. All such variations are within the scope of the present disclosure.

The present disclosure has been described using non-limiting detailed descriptions of examples thereof that are not intended to limit the scope of the general inventive concept. It should be understood that features and/or operations described with respect to one example may be used with other examples and that not all examples have all of the features and/or operations illustrated in a particular figure or described with respect to one of the examples. Variations of examples described will occur to persons of the art. Furthermore, the terms "comprise," "include," "have" and their conjugates, shall mean, when used in the disclosure and/or claims, "including but not necessarily limited to."

It is noted that some of the above described examples may include structure, acts or details of structures and acts that may not be essential to the general inventive concept and which are described for illustrative purposes. Structure and acts described herein are replaceable by equivalents, which perform the same function, even if the structure or acts are different, as known in the art. Therefore, the scope of the general inventive concept is limited only by the elements and limitations as used in the claims.

What is claimed is:

1. An image forming apparatus, comprising:

a substrate receiving member to receive a substrate;

a fluid applicator unit to eject a first set of drops to the substrate received by the substrate receiving member in a print mode and to eject a second set of drops in a maintenance mode, the fluid applicator unit and the substrate receiving member to form a print zone there between; and

an air recirculater assembly to direct air to form an air barrier across the print zone to redirect at least one of aerosols or particulates from crossing through the air barrier and onto the substrate, to filter the at least one of the aerosols or the particulates to form filtered air, and to form the air barrier with the filtered air, wherein the substrate receiving member further comprises:

a substrate receiving area to receive the substrate; and

at least one recirculation opening for the air to pass through the substrate receiving member to a second duct member, wherein the second duct member is to pass the air to the air recirculater assembly, wherein the substrate receiving area further comprises:

a plurality of positioning holes to enable the air recirculater assembly to suck the air to hold the substrate against the substrate receiving area in the print mode; and

at least one maintenance hole to allow the second set of drops ejected from the fluid applicator unit to pass through the substrate receiving member to a maintenance member.

2. The image forming apparatus according to claim **1**, further comprising:

a service unit to receive the second set of drops.

3. The image forming apparatus according to claim **2**, wherein the air recirculater assembly further comprises:

a filter unit to filter the at least one of the aerosols or the particulates from the air; and

an airflow unit to direct the air to pass through the filter unit to form the filtered air and to direct the filtered air to form the air barrier.

4. The image forming apparatus according to claim **3**, wherein the airflow unit further comprises:

a fan to suck the air including the at least one of the aerosols or the particulates through the filter unit to form the filtered air and to push the filtered air across the print zone to form the air barrier.

5. The image forming apparatus according to claim **4**, wherein the airflow unit further comprises:

a first duct member disposed between the fan and the print zone, the first duct member to form a first channel to guide the filtered air from the fan to the print zone; and

wherein the second duct member is disposed between the fan and the substrate receiving member to form a second channel to guide the air to the fan.

6. The image forming apparatus according to claim **5**, wherein the filter unit is disposed in the second duct member.

7. The image forming apparatus according to claim **6**, wherein the service unit further comprises:

the maintenance member to collect the second set of drops.

8. The image forming apparatus according to claim **1**, wherein the fluid applicator unit comprises a page wide inkjet print head array.

9. A method of recirculating air in an image forming apparatus, the method comprising:

transporting a substrate onto a substrate receiving member, wherein the substrate is received at a substrate receiving area of the substrate receiving member;

directing air to form an air barrier across a print zone formed between a fluid applicator unit and the substrate receiving member to redirect at least one of aerosols or particulates from crossing through the air barrier and onto the substrate by an airflow unit of an air recirculater assembly, wherein the directing comprises:

passing the air through the substrate receiving member via at least one recirculation opening of the substrate receiving member to a duct member;

passing the air to the air recirculater assembly via the duct member; and

sucking the air to hold the substrate against the substrate receiving area in a print mode via the air recirculater assembly, wherein the substrate receiving area comprises a plurality of positioning holes to enable the air recirculater assembly to suck the air to hold the substrate against the substrate receiving area in the print mode;

ejecting a first set of drops by the fluid applicator unit through the air barrier to the substrate when the substrate is on the substrate receiving member in the print mode;

filtering the at least one of the aerosols or the particulates from the air by a filter unit of the air recirculater assembly to form filtered air, wherein the filtered air is used by the airflow unit to form the air barrier; and

ejecting a second set of drops by the fluid applicator unit through the substrate receiving member to a service unit in a maintenance mode, wherein the substrate receiving area comprises at least one maintenance hole to allow the second set of drops ejected from the fluid applicator unit to pass through the substrate receiving member to the service unit.

10. The method according to claim **9**,

wherein the filtering the at least one of the aerosols or the particulates from the air further includes sucking the air including the at least one of the aerosols or the particulates through the filter unit by a fan to form the filtered air; and

wherein the directing air to form an air barrier further includes pushing the filtered air across the print zone by the fan to form the air barrier.

11. A non-transitory computer-readable storage medium having computer executable instructions stored thereon for an image forming apparatus to recirculate air, wherein the instructions are executable by a processor to:

transport a substrate onto a substrate receiving member, wherein the substrate is received at a substrate receiving area of the substrate receiving member;

direct air to form an air barrier across a print zone formed between a fluid applicator unit and the substrate receiving member to redirect at least one of aerosols or particulates from crossing through the air barrier and onto the substrate by an airflow unit of an air recirculater assembly, wherein the instructions executable by the processor to direct air comprises the processor to:

pass the air through the substrate receiving member via at least one recirculation opening of the substrate receiving member to a duct member;

pass the air to the air recirculater assembly via the duct member; and

suck the air to hold the substrate against the substrate receiving area in a print mode via the air recirculater assembly, wherein the substrate receiving area comprises a plurality of positioning holes to enable the air recirculater assembly to suck the air to hold the substrate against the substrate receiving area in the print mode;

eject a first set of drops by the fluid applicator unit through the air barrier to the substrate when the substrate on the substrate receiving member in the print mode;

filter the at least one of the aerosols or the particulates from the air by a filter unit of the air recirculater assembly to form filtered air, wherein the filtered air is used by the airflow unit to form the air barrier; and

eject a second set of drops by the fluid applicator unit in through the substrate receiving member to a service unit in a maintenance mode, wherein the substrate receiving area comprises at least one maintenance hole to allow the second set of drops ejected from the fluid applicator unit to pass through the substrate receiving member to the service unit.

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